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Impact of CRM–Based Team Training on Obstetric Outcomes and Clinicians' Patient Safety Attitudes

Stephen D. Pratt, M.D.
Susan Mann, M.D.
Mary Salisbury, R.N.
Penny Greenberg, R.N.
Ronald Marcus, M.D.
Barbara Stabile, R.N.
Patricia McNamee, R.N.
Peter Nielsen, M.D.
Benjamin P. Sachs, M.D.

Medical error is a leading cause of adverse events and patient death.[1] Further, poor communication is a leading cause of medical error.[2,3] Team training based on Crew Resource Management (CRM) has been suggested as a way to improve communication among caregivers and thereby improve patient safety.[1,4] However, little data exist demonstrating that CRM concepts can be integrated into clinical medicine or that they positively influence clinical outcomes. Grogan et al. demonstrated that an eight-hour didactic course on teamwork improved operating room staff attitudes toward teamwork.[5] A similar model increased teamwork behaviors and decreased adverse events in the emergency department (ED).[6] Thompson et al. found that getting intensive care unit clinicians to a multidisciplinary meeting every morning improved daily work flow.[7] Improved perioperative communication has been associated with a decrease in wrong-side surgery[8] and with shorter hospital stays.[9] Multidisciplinary training in simulated obstetric emergencies has been associated with improved midwife and obstetrician knowledge[10] and neonatal outcomes.[11] Finally, the patient mortality rate decreased below predicted in cardiac surgical patients after the implementation of CRM–based teamwork training.[12]

In this article, we demonstrate how we have successfully developed, implemented, and sustained a CRM–based team training process on our obstetrics unit and how this teamwork has had a positive effect both on the attitudes of our staff towards patient safety and on patient outcomes.

From left: *Dennis S. O'Leary, Ronald Marcus, Robert Hanscom (in back), Mary Salisbury, Penny Greenberg, Stephen Pratt (in back), Barbara Stabile, Benjamin Sachs, Susan Mann, and Janet Corrigan.*

Beth Israel Deaconess Medical Center (BIDMC) History

BIDMC is a tertiary care, academic obstetrics department at which approximately 5,000 infants are delivered annually. The obstetric staff is made up of full-time and community physicians. Staffing on labor and delivery (L&D) includes 1 dedicated attending and 2 residents in anesthesia, approximately 11 nurses, 3 obstetric residents, 4

Table 1. Four Teamwork Modules and Skills*

Module	Skill	Description
Communication	SBAR	Structured technique for presentation of relevant patient information
	DESC	Structured technique for conflict resolution
	2-Challenge	Concept that patient safety concern must be verbalized at least twice if it is not corrected
	Check Back	Orders and clinician needs must be repeated back to the sender to ensure that the receiver has understood the message correctly.
	Call Out	Important events are called aloud, especially during rapidly changing situations. Facilitates anticipation of next steps.
	"Stop the Line" Phrase	A word or phrase understood by all to indicate a significant safety concern. It can be spoken in front of awake patients
Situation Monitoring	Situation Monitoring	Actively scanning the unit to assess patients and their plans of care, team member performance, and the environment; looking for potential errors
	Shared Mental Model	When caregivers are aware of the same information, and are thus able to plan and problem solve together
	Situation Awareness	The state of knowing one's surroundings and work condition
Mutual Support	Feedback	A form of verbal support that help colleagues to improve their teamwork
	Advocacy	A form of verbal support that requires staff to advocate for patient safety
	Task Assistance	Asking for or offering assistance when one team member is overworked or attempting to do something beyond their skill set
Leadership	Resource Management	Appropriately re-allocating resources or work load to ensure that no patient is at risk due to overworked staff
	Conflict Resolution	Leaders help resolve interpersonal or medical conflicts using structured language and a chain of command.
	Teamwork Behaviors	The leader ensures that team meetings, briefings, debriefings, and other teamwork behaviors occur.
	Role Clarity	The leader is responsible for ensuring that team members know their roles and responsibilities.

* SBAR, Situation-Background-Assessment-Recommendation; DESC, Describe, Explain, Suggest, Consequences.

attending obstetricians, a perinatologist, and dedicated secretarial, environmental, and surgical scrub support 24 hours a day.

In November of 2000, "Suzanne" was admitted to BIDMC for induction of labor. As a result of a series of errors, her fetus died, and she suffered a ruptured uterus, requiring a hysterectomy, and she spent 18 days in the surgical intensive care unit. By March 2001, Harvard's Risk Management Foundation (RMF) had settled with the family, and BIDMC had issued a public apology.[13] This case highlighted how clinical errors, poor communication, poor coordination of care, and poor teamwork can negatively affect the care we provide and the outcomes of our patients.

In fall 2001, the obstetrics department was approached by the U.S. Department of Defense and RMF to help adapt CRM to obstetrics. The department was the first in obstetrics and one of the first in health care to apply CRM to clinical medicine. This work resulted in a prospective, randomized study on the impact of team training on obstetric outcomes. BIDMC was the lead civilian hospital for this study, although its data were not included in the national study. We helped develop the team-training curriculum for the national study, which was based largely on the approach that had previously been adapted for the ED.[6] However, on the basis of the lessons learned from implementation and literature on the most important aspects of CRM,[14] BIDMC teamwork leadership modified

Table 2. Outcome Measures and Scores*

Outcome Measure	Score
Maternal death	750
Intrapartum & neonatal death > 2500 gm	400
Uterine rupture	100
Maternal admission to ICU	65
Birth trauma	60
Return to OR / labor & delivery	40
Admission to NICU > 2500g & for > 24 hours	35
APGAR < 7 at 5 minutes	25
Blood transfusion	20
3º or 4º perineal tear	5

* ICU, intensive care unit; OR, operating room; NICU,neonatal ICU. Data adapted from Mann S., et al.: Assessing quality in obstetrical care: Development of standardized measures. *Jt Comm J Qual Patient Saf* 32:497–505, Sep. 2006.

this curriculum significantly. Table 1 (page 721) identifies the four basic teamwork modules currently taught at BIDMC and the skills within each module.

As part of the work on the national study, a new set of outcome measures was developed to evaluate the quality of care in obstetrics.[15] These outcome measures could be obtained from hospital discharge data and were clinically relevant. Members of the American College of Obstetricians and Gynecologists Quality Improvement and Patient Safety Committee helped to develop weighted scores for each outcome to help measure the severity of adverse events.[15] Table 2 (above) describes the outcome measures identified and their weighted scores:

- The Adverse Outcome Index (AOI) is the percent of women who experience one or more of the events listed in Table 2.
- The Weighted Adverse Outcome Score (WAOS) is the average number of adverse event points per delivery, and the Severity Index (SI) is the average number of points per woman who experienced an adverse event.

We used these scoring systems to track the impact of our intervention on outcomes. We used the Safety Attitudes Questionnaire (SAQ) to assess staff attitudes about safety.[16]

Implementation Process

Once the CRM curriculum was developed (2002), BIDMC L&D caregivers sought to integrate the behaviors into daily practice. A steering committee, with representation from nursing, anesthesiology, and obstetrics, oversaw the transfer of CRM concepts onto the unit, which entailed the following:

- Ensuring that all staff attended the four-hour training course
- Developing a time line for implementing each CRM concept
- Assigning coaches to each shift
- Developing communication tools to be used on the unit (for example, preoperative briefing template)
- Running an information campaign to keep staff aware of each step of the implementation
- Providing feedback throughout the progress

The steering committee also identified three types of teams:

1. The core team consisted of the core care providers responsible for clinical care (obstetricians and obstetric residents, anesthesiologists, nurses, and unit coordinators).
2. The coordinating team (obstetric chief resident, resource [charge] nurse, attending anesthesiologist, and preassigned attending obstetrician) were charged with organizing work flow, ensuring adequate staffing, identifying and resolving conflicts, and ensuring that appropriate team behaviors (for example, preprocedure briefing, team meetings) occurred.
3. The contingency team, a predetermined group, was responsible for responding to any emergency.

The time line called for one CRM concept to be implemented and emphasized every 1–2 weeks, with a plan for the entire implementation to take 6–12 months.

Approximately 220 staff attended the four-hour course in interdisciplinary groups of 15 to 20 people between April and July 2002. After all the staff were trained, team meetings were the first team behavior implemented. The entire core team was expected to meet at least once every shift. A template was generated to ensure that the appropriate topics were discussed at every meeting. These included patient plans; significant patient history; any obstetric, anesthesia, or nursing concerns; the location and availability of the obstetric provider; staff work load; resources on the unit; and anticipated work load for the unit (for example, planned cesarean deliveries, patients in triage). The rest of the teamwork behaviors and topics were subsequently introduced every 1–2 weeks. Each new topic was preceded by e-mails and communication at team

Table 3. Briefing Template

- Identify team members.
- Identify patient.
- Identify medical concerns.
- Operative plan
- Anesthesia plan
- Allergies
- Antibiotics to be given
- Encourage everyone to raise safety concerns as they arise.

meetings so the staff would be aware of the new emphasis. Coaches were assigned to ensure that each shift had a coach at least once during the time that each topic was emphasized. These coaches spent several hours on the unit coaching the new behaviors and reinforcing those previously taught, but they did not have clinical duties. As preprocedure briefings and postevent debriefings were introduced, templates for each were created and placed on the unit for easy review (Table 3, above). Ultimately, all the teamwork behaviors, skills, and tools were introduced, practiced, and reinforced on the unit.

Once the teamwork system had been implemented, the steering team took steps to sustain the behavioral changes. Teamwork successes were aggressively broadcast. The steering team used e-mails or staff meetings to spread news of improvements in patient care that reflected interdisciplinary input at team meetings. Clinicians who publicly and respectfully "challenged" the care of other providers in the name of patient safety were publicly praised. These success stories were even incorporated into subsequent training sessions. Staff also went through periodic refresher training, and all new staff were required to attend the full four-hour course within several months of hire.

The steering team used input from staff to add new dimensions to patient safety, which was an important step in the sustainment process. For example, in response to concerns that the attending anesthesiologist often arrived at emergencies too late because of poor communication, criteria-based protocols for calling anesthesiologists were developed. Protocols for shoulder dystocia and maternal hemorrhage were developed, as were interdisciplinary drills to practice them. Although these protocols and drills were not specifically part of CRM training, they were made possible by the new teamwork culture and consequently helped to strengthen and drive that culture toward improved outcomes and safety.

Results

AOI. On the basis of data from the National Perinatal Information Center (NPIC), the AOI was measured retrospectively from 1999 through 2001—the three years before implementation. These AOI data were compared to AOI data from 2003–2006, the four years after implementation was complete. The data from 2002 were excluded because the teamwork processes were implemented throughout the year. Between 1999 and 2001, 14,271 women delivered at BIDMC; 836 of these women experienced at least one adverse event, for an average AOI of 5.9% (annual range, 5.3%–6.5%). The average WAOS and SI were 1.15 and 19.59 respectively. During the four years after implementation, 19,380 women delivered, and the average AOI decreased to 4.6%, with an annual range from 4.1% to 5.2%. This represented a 23.0% decrease in adverse obstetric events. Similarly, the WAOS and SI decreased by 33.2% and 13.2%, respectively. The 1.4% absolute drop in the AOI meant that nearly 300 fewer women experienced an adverse event after the implementation of teamwork.

Malpractice Data. Data obtained from the department's malpractice carrier for the 19,960 deliveries performed before training revealed 21 law suits, claims, or observation cases (those of such severity that the carrier opened a file and reserved moneys), 13 (61.9%) of which were considered high severity. After team training, the rate decreased to 16 cases in 20,031 deliveries, of which only 5 (31.3%) were high severity, representing a nearly 62% decrease in the number of high-severity adverse events.

Safety Attitude Questionnaire. Independent of our study, results of BIDMC's SAQ administration in spring 2006 showed that L&D staff had more positive attitudes abut the unit's safety than the rest of the hospital (Figure 1, page 724).

Discussion

We have demonstrated (1) that a CRM-based course can be successfully taught to a large number of staff from multiple departments and (2) that the CRM concepts can be integrated into the clinical work environment when a disciplined implementation process is combined with an

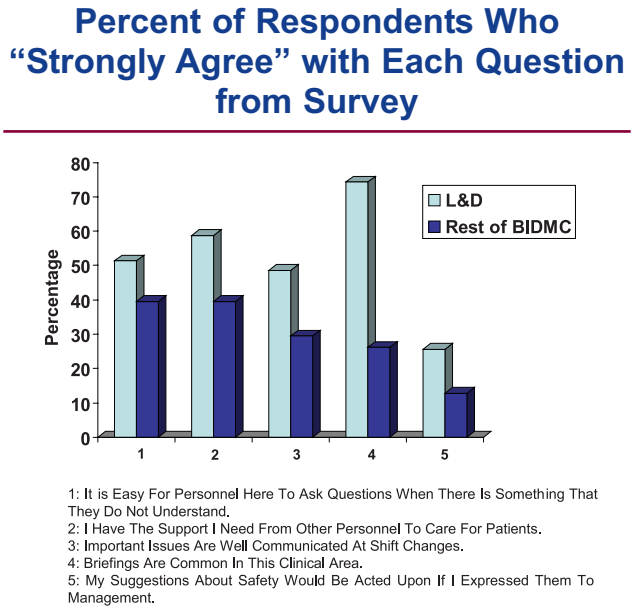

Figure 1. *The results for the administration of the Safety Attitudes Questionnaire, given in Spring 2006, were grouped by medical ward or procedural unit. The percentages of responses that were in agreement with the five questions specifically used to assess the culture on each unit are shown. L&D, labor and delivery; BIDMC, Beth Israel Deaconess Medical Center.*

appropriate team structure; coaching of the behaviors, templates, and other reminders; and a set of clinically relevant outcome measures. These findings are in contrast to those of the earlier prospective, randomized trial in which the authors participated.[17] That trial failed to demonstrate an improvement in the AOI, SI, or WAOS in the team-training group. Several explanations may account for this difference. First, during the national study, sites were evaluated for only five months after the curriculum had been taught. BIDMC teams found that it was difficult to effect meaningful behavioral changes in that period of time. In fact, staff initially complained that the teamwork processes increased their work load because they had to perform new, unfamiliar behaviors in addition to their normal clinical duties. In the present study, additional time was dedicated to implementation to accommodate staff feedback and to ensure acceptance of the behaviors. The steering team and behavioral coaches at BIDMC worked hard to encourage the initial use of teamwork behaviors and to ensure the integration and sustainment of the behaviors into clinical practice across time. In the end, more than a year was required to fully implement all of the behaviors.

A second potential reason that teamwork demonstrated a positive impact on outcomes is that it led to other improvements. Breakdowns in teamwork helped to identify and correct other patient safety concerns. Protocols for massive maternal hemorrhage and shoulder dystocia were developed—not as part of the teamwork curriculum but because of concerns about breakdowns in communication during these critical events.

Third, the teamwork concepts may have been better integrated in the current study than the national study. Although the presence of team behaviors were not formally measured, team meetings and preprocedure briefings, debriefings after major adverse events, and the other teamwork behaviors that were included in the training are now an expected part of daily practice. Staff attitudes demonstrate the degree to which the concepts have taken hold; for example, more than 70% strongly agreed that briefings were common.

Finally, the use of concrete, clinically relevant outcomes helped to drive team success and safety. Team successes and improvements in the AOI, WAOS, and SI were routinely broadcast to the staff. Regular feedback and the strong positive association between teamwork behaviors and patient outcomes can provide strong motivation to continue the teamwork.

The success that the BIDMC L&D teams continue to demonstrate in teaching teamwork, integrating team behaviors into daily practice, and improving patient safety may be important in a context beyond our medical center. The adverse outcomes scores that we used could be used by others to help measure their quality of care and the impact of other patient safety initiatives. NPIC was able to easily calculate these statistics from hospital discharge and demographic data. The educational and implementation processes were standard, relatively simple, and inexpensive. The teams also demonstrated that teamwork requires more than a single intervention. Strong support from departmental and hospital leadership, a dedicated and well-planned implementation schedule, and consistent coaching and sustaining efforts are necessary to effect meaningful change.

The impact of the BIDMC L&D teamwork efforts is beginning to be felt beyond the organization. Currently, all obstetricians covered by Harvard malpractice carrier

must undergo team training. Most of this is now multidisciplinary, including obstetricians, nurses, and anesthesiologists. More than 60 hospitals are now using the AOI to track the quality of their obstetric care.[18] The EDs at the Harvard-affiliated institutions are undertaking a process to develop their own "AOI" and then to implement team training. Members of the BIDMC L&D staff have helped develop a Commonwealth of Massachusetts initiative, a statewide initiative, the Safe Delivery Project, to encourage all birthing hospitals to adopt team training and the RMF clinical guidelines and to measure outcomes using the AOI.

Conclusion

CRM concepts can be taught to a large staff, and associated behaviors can be transferred to the clinical environment. In the BIDMC experience, the implementation of CRM–based team training was associated with a significant decrease in the frequency and severity of adverse events and in malpractice claims, as well as with high staff scores on a patient safety attitude questionnaire. These successes can be transferred to other clinical environments. J

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Stephen D. Pratt, M.D., is Clinical Director, Obstetric Anesthesia, Department of Anesthesia, Critical Care, and Pain Medicine, Beth Israel Deaconess Medical Center (BIDMC), Boston; **Susan Mann, M.D.,** is Director of Quality Improvement, Department of Obstetrics and Gynecology. **Mary Salisbury, R.N.,** is President of the Cedar Institute, Kingston, Rhode Island. **Penny Greenberg, R.N.,** is Director of Healthcare Quality and Patient Safety, Beth Israel Deaconess Hospital, Needham, Massachusetts. **Ronald Marcus, M.D.,** is Director, Outpatient Services Department, Department of Obstetrics and Gynecology, BIDMC, and **Barbara Stabile, R.N.,** is Nurse Manager, Labor and Delivery. **Patricia McNamee, R.N.,** was Nurse Manager, Labor and Delivery. **Peter Nielsen, M.D.,** is Chairman, Department of Obstetrics and Gynecology, Madigan Army Medical Center, Tacoma, Washington. **Benjamin P. Sachs, M.D.,** formerly Harold Rosenfeld Professor, Harvard Medical School, Boston, is Senior Vice President, Tulane University and School of Medicine, New Orleans. Please send requests for reprints to Stephen Pratt, spratt@bidmc.harvard.edu.